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THE TYPE CONCEPT IN SYSTEMATIC BOTANY¹

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The binomial system of nomenclature has been an important factor in the development of taxonomy. The increase in the number of known species since the time of Linnaeus has been many fold; because of carelessness and ignorance the number of names applied to the species of plants has been much greater than the number of species; the increase in our knowledge of genetic relationships and the diversity of opinions among botanists concerning generic limitations have still further increased the synonymy. The confusion arising from these causes soon emphasized the need of a code of nomenclature by which the naming of plants might be regulated. Many codes have been proposed, but only two have received the support of international conferences: the Paris Code of 1867, and the Vienna Code of 1905.

I have pointed out in another place (*Science* n. ser. **30**: 597. 1909) that absolute stability in nomenclature is unattainable so long as botany is a growing science. The limits of genera will vary according to the knowledge and the opinions of individual workers, and the names of the plants as they are assigned to this or that genus will change in a corresponding degree. A universal code cannot bring about a permanent nomenclature, but it enables botanists to apply names according to definite rules, and this is all that we may expect of any code.

The two codes mentioned have been a great help in stabilizing nomenclature. Experience has shown, however, that they lack definiteness in directing the application of names, especially of generic names. In the early days of taxonomy a name was applied to a concept rather than to an entity. A generic name was based upon all the known species of the genus; a specific name was based upon all the known specimens of the species. When a genus was divided the original name was retained for one of the parts, usually the larger part, or was sometimes discarded altogether. The Vienna Code introduced many reforms, but the procedure for applying names when a genus or species was divided was still vague and uncertain in its application.

About 30 years ago a new system began to receive serious attention among American botanists, the system of applying names by means of types. It is not my purpose here to give a history of this idea, but rather to point out some of the advantages of the system. The type concept lies

¹ Read before the Systematic Section of the Botanical Society of America at Chicago, December 29, 1920.

at the basis of modern botanical nomenclature. The type species of a genus or the type specimen of a species is the species or the specimen respectively that directs or controls the application of the generic or specific name. A generic name shall always be so applied as to include its type species; a specific name shall always be so applied as to include its type specimen. The old concept was that a genus was a group of species having a given combination of characters; a species, similarly, a group of specimens. The new or type concept is that, from the nomenclatural standpoint, a genus is a group of species allied to the type species, a species a group of individuals similar to the type specimen.

If a genus or species is divided, that part which includes the type species or specimen retains the generic or specific name, be this part relatively large or small. The American Code² recognized the type concept as a fundamental principle. The Paris and Vienna codes do not refer to this principle. But the idea had made such headway by 1910 that it was recognized by the Brussels Congress in a recommendation as a guide for the future (an addition to Recommendation XVIII). This reads:

[Botanists will do well, in publishing, to conform to the following recommendations: XVIII . . .] XVIII *bis*. When one publishes the name of a new group, to indicate carefully the subdivision which is considered to be the nomenclatural type of the group; the type genus of a family, the type species of a genus, the type variety or the type specimen of a species. This precaution avoids the nomenclatural difficulties in the case where, in the future, the group in question comes to be divided. (Act. Congr. Internat. Bot. Brux. 1910 1: 105.)

It is to be regretted that this recommendation was not made retroactive. I feel confident that the retroactive fixation of nomenclatural types is a fundamental necessity in stabilizing nomenclature. I feel confident also that this aspect of the type concept will appeal more and more strongly to the followers of the Vienna Code as its advantages are recognized, especially as there is nothing in the concept that is contrary to the principles of that code. One must carefully distinguish between the concept itself and the rules for its application. The American Code has recognized the principle of types and has also formulated rules for type fixation. One may accept the principle and reject these particular rules.

The congress which adopted the Vienna Code appears to have been actuated by a desire to formulate rules that should, in a general way, preserve the current usage of generic names. I wish to point out to the followers of the Vienna Code that this laudable purpose can be accomplished with greater definiteness by applying the type concept than by applying the vague and uncertain rules adopted by the Vienna Congress.

The Vienna Code contains the following rule:

ART. 45. When a genus is divided into two or more genera, the name must be kept and given to one of the principal divisions. If the genus contains a section or some other

²Formulated in 1907 by a Nomenclature Commission of the Botanical Club of the American Association for the Advancement of Science.

division which, judging by its name or its species, is the type or the origin of the group, the name is reserved for that part of it. If there is no such section or subdivision, but one of the parts detached contains a great many more species than the others, the name is reserved for that part of it.

Let us apply this rule to the Linnaean genus *Panicum*. There are 20 original Linnaean species. Several of them, including *P. miliaceum* and its allies, belong to the genus *Panicum* as delimited by most modern botanists. Among the 20 are also *P. italicum* and its allies, now generally distinguished as *Setaria* or *Chaetochloa*. But *Panicum italicum* is the historic type of *Panicum*, that is, the species which was known as *Panicum* by pre-Linnaean authors and the one which I should interpret as, "judging from its name or its species, is the type or the origin of the group," and therefore the segregated genus containing it should have retained the name *Panicum*. However, in the process of taxonomic and nomenclatural development of the various species involved, this procedure was not followed. If botanists wish to retain the name for the allies of *Panicum miliaceum*, the simplest method to insure this result is to select *Panicum miliaceum* as the type of *Panicum*.

The Linnaean genus *Holcus*, presenting certain complications, illustrates the advantage of the type method. The name in pre-Linnaean literature was applied to the sorghums, but in the *Species Plantarum* Linnaeus unites with the three species of the sorghum group four other species of diverse relationships, one of which is *Holcus lanatus*, the only one of the species belonging to *Holcus* as now recognized by European botanists. The Vienna Code provides (Art. 19) that

It is agreed to associate genera, the names of which appear in this work [*Species Plantarum*] with the descriptions of them in the *Genera Plantarum* ed. 5 (1754).

According to the Vienna Code (as well as to the American and Type-basis codes) the name *Holcus* should be applied to the sorghums and this I have done, since the author's concept is most accurately interpreted by his own description. But when the aggregate included under *Holcus* by Linnaeus in 1753 was divided, a century or more ago, the sorghums and species of other genera were taken out and the name *Holcus* was left for *H. lanatus*, which until recently has generally borne that name. The followers of the Vienna Code have accepted current usage regardless of the rules of that code. Would it not be simpler and more definite to make an exception and to crystallize current usage by fixing *Holcus lanatus* as the type of *Holcus*?

Examples could be multiplied indefinitely. Apparently the rules of the Vienna Code were left indefinite in order that botanists should not be too much restricted in the application of names and should have some freedom to use personal judgment. It is impossible to foresee all contingencies and to provide for them by definite rules. As shown above, when, in particular cases, the rules lead in the wrong direction they are likely to be ignored. The desired results can be accomplished with much greater

precision by using the type method. I commend to the followers of the Vienna Code the proposal that the International Rules be modified by a recommendation to the effect that the application of names be fixed by means of nomenclatural types, this to apply retroactively.

The American Code provides for fixing the application of names by means of types. It goes further and provides rules for determining the type. It should be emphasized that the acceptance of the concept of types does not involve the acceptance of a particular set of rules for selecting types.

The code formulated by the Committee on Nomenclature of the Botanical Society of America is called the Type-basis Code of Nomenclature. Like the American and the Vienna codes, the rules of the Type-basis Code are founded on the principle of priority. The rules for selecting types of genera and of species are in conformity with this principle, while, as stated previously, the Vienna Code omits altogether the rules for selecting types (though *type* appears incidentally in Art. 45 as indicated above). It will be seen then that the chief difference between the Vienna Code and the new Type-basis Code is that the one ignores the subject and the other formulates rules for selecting types. If the Vienna Code could be modified to include a set of acceptable rules governing the selection of types, the most important difference between the two codes would disappear.

Attention should here be called to the fact that selecting the type of a group does not validate the name of that group. Types are selected for both valid names and synonyms. It only means that if a certain name is used it should be so applied as to include the type.

I will review briefly the proposed rules for selecting the types of genera. I will pass over certain particular cases such as those in which there was but one species in the genus as originally published, or in which the type was designated originally, and refer to the troublesome cases where there were several species included in the genus as originally published. This is true of many Linnaean genera, and the typification of these is basic so far as stability of nomenclature is concerned. There was an attempt at one time to select arbitrarily the first species as the type. This would be definite, but would often run counter to the historic development of the group and would cause so many changes in names as to introduce serious and needless confusion. The new code provides for selection by applying the rule of reason, taking into consideration all the factors in each case. In preparing a recent bulletin I found it necessary to typify over 300 grass genera. I will select a few examples from these. If the genus was used in his earlier works, *Flora Lapponica* or *Flora Suecica*, the type should be chosen from among those in the *Species Plantarum* that are cited by Linnaeus as being in one of the earlier works, since these are the species with which he was more familiar. Under *Andropogon* in the *Species Plantarum* Linnaeus describes 12 species. The name *Andropogon* was first used in the *Flora*

Leidensis where two species are described, both being included in the *Species Plantarum*. From these two *Andropogon virginicus* was chosen as the type because that species retained the name in its usual significance. The other species, *A. hirtus*, is now by many botanists referred to a different genus.

Poa L. Linnaeus describes 17 species. He first used the genus in his *Flora Lapponica*. From among the species there described *Poa pratensis* is selected as the type because that retains the name of this economic species in its usual signification.

Uniola L. Two species are described. One is referred now to *Distichlis*. The other is selected as the type, thus retaining the name in its current usage.

Hordeum L. Six species are described. The reference in the *Genera Plantarum* is to figure 295 in Tournefort's work, representing *Hordeum vulgare*, the common barley, which is therefore selected as the type.

Aira L. Of the 14 species described four are included in the *Flora Lapponica*. To take the first of these as the type would transfer the name *Aira* to what we now call *Trisetum*. Hence another one of the four, *A. caespitosa*, is selected in order to retain the name in its usual signification. Some botanists apply the name *Aira* to the last two of the 14 original species, including *A. caryophyllea*, and refer *Aira caespitosa* and its allies to *Deschampsia*. These two species are from southern Europe and were not included by Linnaeus in his first use of the term *Aira* in the *Flora Lapponica*, and hence did not represent Linnaeus's original idea of the genus.

In general, one should ascertain if possible what species or group of species an author had chiefly in mind in establishing a new genus.

The application of the type concept to species is similar. If more than one specimen is cited, one should find which one the author had chiefly in mind. This may be shown by comparison with the description, by one having been selected for an illustration, by notes on the original sheet, by the specific name. Only when other methods fail should the first specimen cited be arbitrarily selected.

The above illustrates what is meant by applying the rule of reason in the selection of types. Let us hope that soon all taxonomic botanists will accept the concept of types and that they may agree on the types to be selected.

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